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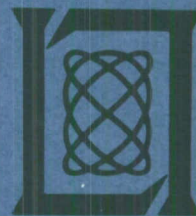
ESTI CONTROL NR. **AL#-41612**CY NR. 7 OF 1 CYS**Group Report****1964-40****H. E. Frachtman****Haystack Pointing System: Sun****29 July 1964**

Prepared under Electronic Systems Division Contract AF 19(628)-500 by

Lincoln Laboratory

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Lexington, Massachusetts

**AD603318**

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY

HAYSTACK POINTING SYSTEM: SUN

H. E. FRACHTMAN

Group 62

GROUP REPORT 1964-40

29 JULY 1964

LEXINGTON

MASSACHUSETTS

ABSTRACT

This memorandum describes the method used by the Haystack pointing computer program for obtaining the celestial coordinates of the SUN at any time.

Accepted for the Air Force
Franklin C. Hudson, Deputy Chief
Air Force Lincoln Laboratory Office

I. INTRODUCTION

SUNTRACK is a program in the Haystack Univac 490 pointing system whose output is the celestial coordinates of the Sun at a given time. The program computes the coordinates by 3rd difference interpolation in the tables of the apparent right ascension, declination, and radius vector of the Sun published in The American Ephemeris. The rates of change of the three quantities are computed by numerical differentiation.

II. INPUTS TO PROGRAM

A. Inputs Furnished by Core Memory

The program uses the registers listed in Table I for input information. The year and day are used to select the appropriate entries from the Sun's ephemeris. The coordinates of the Sun are interpolated for the time which is the sum of the times in CELTIME AND DELTATEE.

B. Inputs Furnished by Magnetic Tape

The tape format of the Ephemeris for the Sun, which has been edited and recorded by a 7094 program described in Reference (1), is shown in Fig. 1. Each block of 288 words covers a period of 32 days. The ephemeris for each day required 9 words. The program does not make use of the semi-diameter or the year-month-day words in the block. The tape must be on Unit 1 (normally Servo B).

III. PROGRAM OUTPUTS

A. Outputs Left in Core Memory

The apparent celestial coordinates of the Sun, corresponding to the time in the register CELTIME, together with their numerical derivatives, are stored in the appropriate registers, as illustrated in Table II.

B. Typewriter Outputs

During initialization the SUNTRACK program will type, using the INTERCOM sub-routine, certain information concerning the SUN. Items printed are:

| <u>Register</u> | <u>Contents and Scaling</u> |
|-----------------|-----------------------------|
| W(CELTIME) | Days B28 |
| W(DELTATEE) | Days B28 |
| U(YEARMONTH) | Year B15 (4 decimal digits) |
| L(YEARMONTH) | Month B0 |
| L(DAY) | Day of Year B0 |

TABLE I
Core Memory Inputs to SUNTRACK Program

NOTE: Notation "B28" means that the binary point is to the right of bit 28.

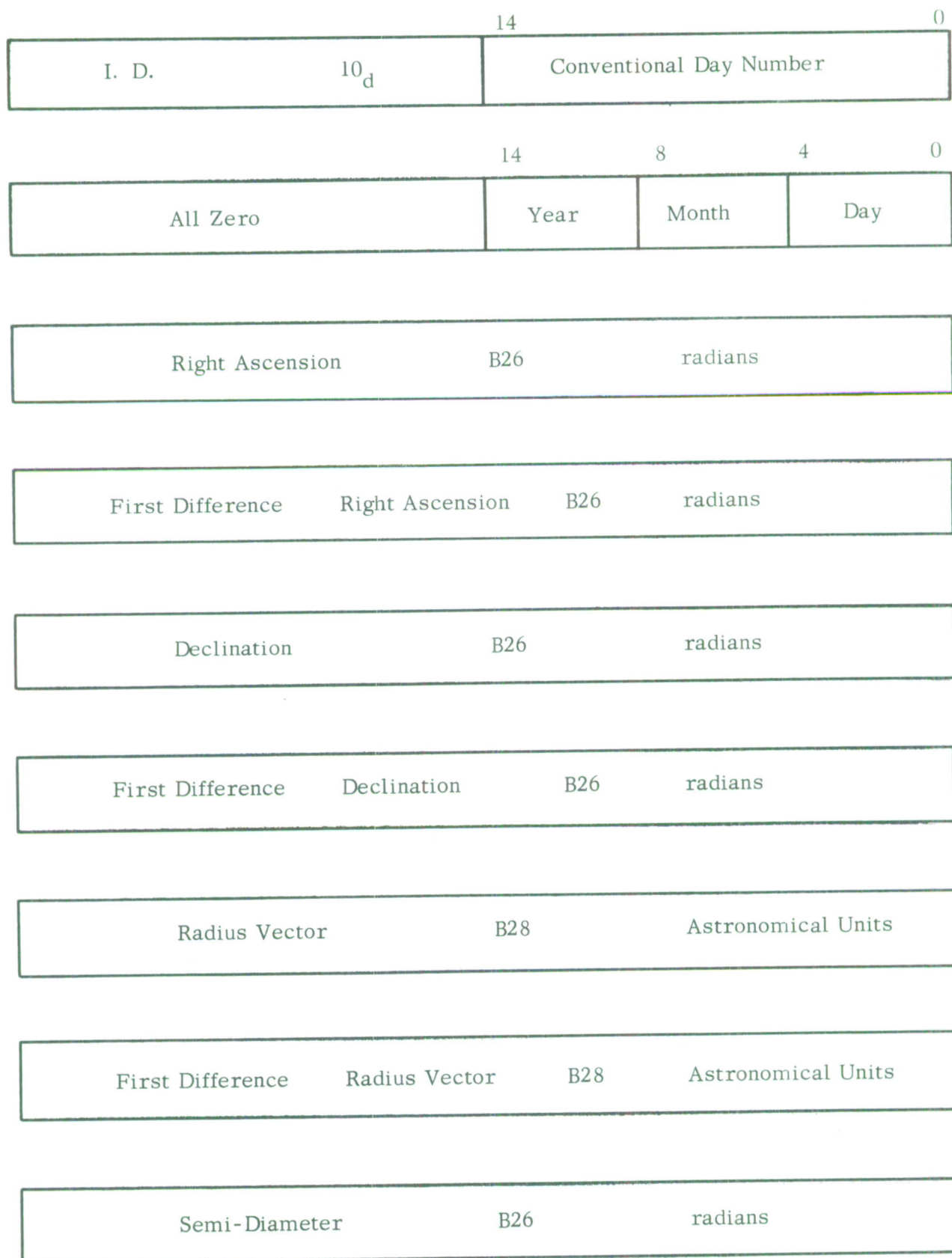


Fig. 1. Magnetic Tape Format for SUN Ephemeris

| | |
|---------------|---|
| W(RA) | Apparent Right Ascension B27 in revolutions |
| W(DEC) | Apparent Declination B27 in revolutions |
| W(RADIUS) | One's complement of distance from center of earth to surface of Sun B24 in Astronomical units |
| W(RADOT) | Numerical Derivative of Right Ascension B37 radians/sec. |
| W(DEC DOT) | Numerical Derivative of Declination B37 radians/sec. |
| W(RADIUS DOT) | Numerical Derivative of Radius Vector B24 nautical miles/sec. |

TABLE II

Core Memory Outputs of SUNTRACK Program

1. Julian Day corresponding to values in YEARMONTH, DAY, and CELTIME (7 digits).
2. Apparent Right Ascension of SUN (Hours, Minutes, Seconds to hundredths).
3. Apparent Declination of SUN (Degrees, Minutes, Seconds to hundredths).
4. Day of Year (Up to 3 digits).
5. Universal Time for which the coordinates are interpolated. It is the time in CELTIME at initialization (Hours, Minutes, Seconds to hundredths).
6. The distance between the centers of the Earth and Sun (Astronomical Units to hundred millionths).
7. The work "SUN".

If, after a search through 9 files on Unit 1 (or the finding of an end of tape mark), the sun ephemerides are not found, the program will type "SUN EPHEMERIS FOR X/Y NOT AMONG FIRST 9 FILES" and will exit to the master control program error return. "X" and "Y" indicate the current month and year, respectively.

If there is a tape servo malfunction during search, the program will type "IIC STATUS S1 ZZ" and will exit to the master control program error return. The two digit octal number "ZZ" comes from the tape status word and indicates the error condition.

IV. ASTRONOMICAL SIGNIFICANCE

The apparent right ascension and declination of the SUN in the ephemerides are referred to the true equinox and equator of date and are corrected for planetary aberration. They are geocentric apparent quantities; the parallax correction is made by the coordinate conversion program (COCON) in the Haystack system. The values in the tables are computed for Ephemeris Time as argument. The equation

$$ET = UT + \Delta T$$

is used to convert from Universal Time to Ephemeris Time. The constant ΔT , represented by the number in the register DELTATEE is approximately 35 seconds.

The radius vector is the actual geometric distance in astronomical units between the centers of the Earth and Sun at the stated time.

The number 934.91 is used to convert astronomical units per day to nautical miles per second in the computation of the number in RADIUSDOT.

$$934.91 = \frac{499.005 \times 2.997925 \times 10^5}{1.852 \times 86400}$$

499.005 = number of seconds per astronomical unit

2.997925×10^5 = velocity of light in kilometers per second

1.852 = kilometers per nautical mile

86400 = seconds per day

A comprehensive explanation of the ephemerides is given in Reference (2).

V. PROGRAM DETAILS

The SUNTRACK program is a subroutine of the Haystack Univac 490 pointing program. The initialization section begins at SUNINIT, the working section at SUNCONT. There are several closed subroutines within SUNTRACK. These are: DAYFIND, STATUSCK, INTERPOL, LEFRNDOFF, and ROUND OFF. A listing of the program is given in Appendix I.

A. Initialization

The program, upon initialization, stores an RIL instruction in the tape channel internal interrupt register and an RJP STATUSCK instruction in the external interrupt register. The area in core into which the tape data will be read is cleared, together with some additional registers. This is done to make diagnosis easier in case of malfunction.

The SUN Ephemeris entries are serially numbered by the program which generates the magnetic tape (Reference 1). These serial numbers are called "Conventional Day Numbers" (CDN). An arbitrary decision was made to produce and use tapes such that the CDN for 25 April 1963 is zero. The tape search process looks at the first word in each block, therefore, the SUNTRACK program must compute the CDN of the first word of the block containing the entry for the required day.

Using as inputs the year, day of year, and the effect of integral and half-integral values of CELTIME, the program computes the Julian Day number for the typewriter. The ephemerides start and run continuously from 25 April 1963, which has a Julian

Day Number of 2438144.5; this number is subtracted from the computed Julian Day number to find the Conventional Day Number. (It is 6 for 1 May 1963, the first day for which ephemerides tapes were made for the system.)

The first CDN in each block will be given by $6 + 32n$ where n is a positive integer or zero. The first CDN in a block is stored in TAPEBLOCK (lower half) and the SUN identification number 10_d is added to generate a tape search comparison word, stored in TAPESearch and also in SAFE.

The number in SLOTBLOCK represents the number of the entry in the 32-word block.

If $1 < \text{SLOTBLOCK} \leq 29$, only one block need be read in; if not, either the preceding or following tape block should also be read to provide sufficient ephemerides for 3rd order Bessel interpolation for a four-day period.

If the one-or two-block search and read operations are successful, control is regained at NORMAL and the tape is rewound without interrupt or interlock. At this time, SUN ephemerides for either 32 or 64 days are in core memory.

Besselian interpolation of right ascension is done by the INTERPOL subroutine and the interpolated result is converted to hours, minutes, and seconds and stored for type out. Declination and distance are then interpolated and stored for type out. The other quantities which are to be typed out by INTERCOM are set up. Control is transferred to INTERCOM 7 times for the seven line type out, which completes operation of the initialization section of SUNTRACK.

B. Working Section

The SUNTRACK working section begins at SUNCONT. Control is transferred to the subroutine DAYFIND which selects the day's ephemeris entry, stores the addresses of the table entries, and computes the interpolation argument P from the given value of CELTIME. The INTERPOL subroutine is then entered three times for the interpolation of right ascension, declination, radius and their time rates. An amount corresponding to the SUN's radius is subtracted from the interpolated value for accurate radar range

control. All values are converted, scaled and stored properly in core memory and control is transferred to the master control program.

C. Subroutines

The initialization section of the SUNTRACK program makes use of the INTERPOL, DAYFIND, STATUSCK, LEFRNDOFF, and ROUNDOFF subroutines. The working section uses all except STATUSCK.

1. INTERPOL

The SUNTRACK interpolation subroutine uses Bessel's interpolation formula (Reference 3) for 3rd difference interpolation of the ephemeris. The formula is

$$f_P = f_0 + P\delta f_{1/2} + \frac{P(P-1)}{4} [\delta^2 f_0 + \delta^2 f_1] \\ + \frac{P(P-1)(P-1/2)}{6} \delta^3 f_{1/2}$$

The quantities in the formula are associated with computer registers as follows:

- a. The address of f_0 is in index register 4.
- b. The interpolation argument P is in register P.
- c. $\delta f_{1/2}$ is in register GAMMA.
- d. $P(P-1)$ is in register PSQMP.
- e. $\delta^2 f_0 + \delta^2 f_1$ is in register DMINB.
- f. $\frac{P(P-1)}{6}$ is in register PSQMP6.
- g. $\delta^3 f_{1/2}$ is in register DMIN2CPLB.
- h. f_P is in the A register at the finish.

The subroutine also performs numerical differentiation using the following formula (Reference 3):

$$hf'_P = \delta f_{1/2} + \frac{2P-1}{4} [\delta^2 f_0 + \delta^2 f_1] \\ + \frac{3P^2 - 3P + 1/2}{6} \delta^3 f_{1/2}$$

At the completion of the subroutine, hf'_P is stored in the register NUMDERIV.

When the subroutine is entered, Index Register 4 contains the address of f_0 and the register SETINTAD contains the address of $\delta f_{1/2}$ of the quantity to be interpolated. Index register 3 is used to acquire the other two first difference registers.

2. DAYFIND

The DAYFIND subroutine computes the addresses of the ephemeris entries corresponding to the current day. It also computes the interpolation argument P by properly scaling the sum of CELTIME and DELTATEE. The value of P is always positive, even though time be set negative by the system control programs. The number in DAYINDEX, which can be -2, -1, 0, or +1, takes account of the effect of the integral part of CELTIME on the selection of ephemeris entry.

3. STATUSCK

The STATUSCK subroutine is entered from the external interrupt register associated with the tape channel when the interrupt occurs. Examination of the status code generates four possible outcomes:

- a. If the code indicates a normal completion (40), control is returned to the program at the interrupted point.
- b. If the code indicates that an end of tape mark was sensed, the tape is rewound and a message indicating failure to find the ephemeris is printed by the typewriter. The message is described in Section III B. Control is passed to the error return of the master control program.
- c. If the code indicates that an end of file mark was sensed, the register IMPERIAL is indexed and tested for the value 9. When less than 9, the next file is searched by passing control to TRYAGAIN. When IMPERIAL equals 9, an end of tape condition is assumed and the action is as described in (b) above.
- d. If the code indicates anything but end of file, end of tape, or normal completion, a tape error has occurred. The message described in Section III B, indicating the type of error is printed by the typewriter and control is passed to the error return of the master control program.

4. LEFRNDOFF

The LEFRNDOFF subroutine left shifts the AQ register the number of places indicated by the contents of index register 5 and rounds the A register.

5. ROUND OFF

The ROUND OFF subroutine right shifts the AQ register the number of places indicated by the contents of index register 5 and rounds the A register.

APPENDIX I

SPURT OUTPUT NO. 210

FRACHTMAN*7/14/64

| CARDS | LI | ID | LABEL | TA | STATEMENT | SUNTRACK | LOC | F | JKB | Y | NOTES |
|-------|----|----|-----------|----------------|-------------------|----------|-------|---|-------|-------|-------|
| 00000 | | | SUNTRACK | PROGRAM | FRACHTMAN*7/14/64 | | 00000 | | | | |
| 00001 | | | SOLAR | EQUALS | 100 | | 00001 | | 00177 | 00002 | |
| 00002 | | | MONITAPE | EQUALS | 55 | | 00002 | | 30322 | 32514 | |
| 00003 | | | TAPEINPUT | EQUALS | 35 | | 00003 | | 61000 | 00000 | |
| 00004 | | | EPHEM | MEANS | C15* | | 00004 | | 11030 | 00766 | |
| 00005 | | | HENRY | U-TAG | SUNC0NT*SUNINIT | | 00005 | | 15030 | 00055 | |
| 00006 | | | | FD | 1*SUNP3 | | 00006 | | 11030 | 00767 | |
| 00007 | | | SUNINIT | ENTRY | | | 00007 | | 15030 | 00035 | |
| 00008 | | | | ENT | A*(IGNORE) | | 00008 | | 12400 | 01555 | |
| 00009 | | | | STR | A*(MONITAPE) | | 00009 | | 11000 | 00000 | |
| 00010 | | | | ENT | A*(INTERUPT) | | 00010 | | 15034 | 01413 | |
| 00011 | | | | STR | A*(TAPEINPUT) | | 00011 | | 72400 | 00011 | |
| 00012 | | | | ENT | B4*877D | | 00012 | | 11020 | 63147 | |
| 00013 | | | | CL | A* | | 00013 | | 21000 | 03651 | |
| 00014 | | | | STR | A*(YRREMAIN+84) | | 00014 | | 15030 | 00746 | |
| 00015 | | | ERASE | BJP | B4*ERASE | | 00015 | | 03000 | 00036 | |
| 00016 | | | | ENT | A*(YEARMONTH) | | 00016 | | 23000 | 00004 | |
| 00017 | | | | SUB | A*1961D | | 00017 | | 15030 | 01413 | |
| 00018 | | | | STR | A*(MONTHPRINT) | | 00018 | | 22000 | 02665 | |
| 00019 | | | | RSH | AQ*30D | | 00019 | | 14030 | 01414 | |
| 00020 | | | | DIV | 4 | | 00020 | | 10030 | 01413 | |
| 00021 | | | | STR | A*(YRREMAIN) | | 00021 | | 22000 | 00555 | |
| 00022 | | | | MUL | 1461D | | 00022 | | 34030 | 01414 | |
| 00023 | | | | STR | Q*(WHOLEYEAR) | | 00023 | | 65000 | 00274 | |
| 00024 | | | | ENT | Q*(YRREMAIN) | | 00024 | | 10030 | 01417 | |
| 00025 | | | | MUL | 365D | | 00025 | | 05000 | 00005 | |
| 00026 | | | | RPL | Y+Q*(WHOLEYEAR) | | 00026 | | 26000 | 00006 | |
| 00027 | | | | RJP | DAYFIND | | 00027 | | 26030 | 00771 | |
| 00028 | | | | ENT | Q*(TAPEBLOCK) | | 00028 | | 14130 | 01430 | |
| 00029 | | | | LSH | Q*5 | | 00029 | | 10030 | 01421 | |
| 00030 | | | | ADD | Q*6 | | 00030 | | 10000 | 00035 | |
| 00031 | | | | ADD | Q*(IDENT) | | 00031 | | 14030 | 01430 | |
| 00032 | | | | STR | Q*(SAFE)*SKIP | | 00032 | | 14030 | 01421 | |
| 00033 | | | | ENT | Q*(SAFE) | | 00033 | | 10000 | 00001 | |
| 00034 | | | | STR | Q*(TAPESEARCH) | | 00034 | | 04430 | 01420 | |
| 00035 | | | | ENT | Q*29D | | 00035 | | 61000 | 00510 | |
| 00036 | | | | ENT | A*1 | | 00036 | | 73670 | 00541 | |
| 00037 | | | TRYAGAIN | Q*(TAPESEARCH) | | | 00037 | | | | |
| 00038 | | | | ENT | Q*29D | | 00038 | | | | |
| 00039 | | | | ENT | A*1 | | 00039 | | | | |
| 00040 | | | | Q*(TAPESEARCH) | | | 00040 | | | | |
| 00041 | | | | Q*(TAPESEARCH) | | | 00041 | | | | |
| 00042 | | | | Q*(TAPESEARCH) | | | 00042 | | | | |
| 00043 | | | | Q*(TAPESEARCH) | | | 00043 | | | | |
| 00044 | | | | Q*(TAPESEARCH) | | | 00044 | | | | |
| 00045 | | | | Q*(TAPESEARCH) | | | 00045 | | | | |
| 00046 | | | | Q*(TAPESEARCH) | | | 00046 | | | | |
| 00047 | | | BLOCKBEE | Q*(TAPESEARCH) | | | 00047 | | | | |

1ST TEMP STORAGE

(0,1,2,3)
DAYS IN 4 YRS

FRACHTMAN*7/14/64

| CARDS | LI | ID | LABEL | TA | STATEMENT | SUNTRACK | LUC | F | JKB | Y | NOTES |
|-------|-------|--------|-------|----|----------------------|---------------------|-------|-------|-------|-------|-------|
| . | 00050 | | | | N0-DP | | 00043 | 12000 | 00000 | 00000 | |
| . | 00051 | | | | EX-FCT | EPHEM*W(SRHIBIN) | 00044 | 13670 | 00765 | 00000 | |
| . | 00052 | | | | N0-DP | | 00045 | 12000 | 00000 | 00000 | |
| . | 00053 | | | | EX-FCT | EPHEM*W(TAPESEARCH) | 00046 | 13670 | 01421 | 00000 | |
| . | 00054 | | | | JP \$ | | 00047 | 61000 | 00047 | 00000 | |
| . | 00055 | NORMAL | | | EX-FCT | EPHEM*W(REWINDN0) | 00050 | 13670 | 00770 | 00000 | |
| . | 00056 | | | | ENT B4*L(RAAD) | | 00051 | 12410 | 01422 | 00000 | |
| . | 00057 | | | | ENT A*L(RADIFAD) | | 00052 | 11010 | 01425 | 00000 | |
| . | 00058 | | | | STR A*L(SETINTAD) | | 00053 | 15010 | 01053 | 00000 | |
| . | 00061 | | | | RJP INTERPOL | | 00054 | 65000 | 01054 | 00000 | |
| . | 00062 | | | | ENT Q*0*ANEG | | 00055 | 10700 | 00000 | 00000 | |
| . | 00063 | | | | SUB A*W(TW0PIE)*AP0S | | 00056 | 21630 | 01004 | 00000 | |
| . | 00064 | | | | ADD A*W(TW0PIE) | | 00057 | 20030 | 01004 | 00000 | |
| . | 00065 | | | | RSH AQ*27D | | 00060 | 03000 | 00033 | 00000 | |
| . | 00066 | | | | DIV W(HRAD) | | 00061 | 23030 | 00773 | 00000 | |
| . | 00067 | | | | STR Q*W(RA2) | | 00062 | 14030 | 00624 | 00000 | |
| . | 00070 | | | | CL Q* | | 00063 | 10000 | 00000 | 00000 | |
| . | 00071 | | | | RSH AQ*23D | | 00064 | 03000 | 00027 | 00000 | |
| . | 00072 | | | | DIV W(MINSRAD) | | 00065 | 23030 | 00774 | 00000 | |
| . | 00073 | | | | STR Q*W(RA4) | | 00066 | 14030 | 00627 | 00000 | |
| . | 00074 | | | | RSH AQ*30D | | 00067 | 03000 | 00036 | 00000 | |
| . | 00075 | | | | MUL W(SRAD) | | 00070 | 22030 | 00772 | 00000 | |
| . | 00076 | | | | LSH AQ*2*QP0S | | 00071 | 07200 | 00002 | 00000 | |
| . | 00077 | | | | ADD A*1 | | 00072 | 20000 | 00001 | 00000 | |
| . | 00100 | | | | STR A*W(RA6) | | 00073 | 15030 | 00632 | 00000 | |
| . | 00101 | | | | ENT B4*L(DECAD) | | 00074 | 12410 | 01423 | 00000 | |
| . | 00102 | | | | ENT A*L(DECIFAD) | | 00075 | 11010 | 01426 | 00000 | |
| . | 00103 | | | | STR A*L(SETINTAD) | | 00076 | 15010 | 01053 | 00000 | |
| . | 00104 | | | | RJP INTERPOL | | 00077 | 65000 | 01054 | 00000 | |
| . | 00105 | | | | STR A*W(GM12) | | 00100 | 15030 | 00712 | 00000 | |
| . | 00106 | | | | ENT Q*0*AP0S | | 00101 | 10600 | 00000 | 00000 | |
| . | 00107 | | | | CP A* | | 00102 | 15040 | 00000 | 00000 | |
| . | 00110 | | | | RSH AQ*22D | | 00103 | 03000 | 00026 | 00000 | |
| . | 00111 | | | | DIV W(MINSRAD) | | 00104 | 23030 | 00774 | 00000 | |
| . | 00112 | | | | STR Q*W(DLN2) | | 00105 | 14030 | 00657 | 00000 | |
| . | 00113 | | | | CL Q* | | 00106 | 10000 | 00000 | 00000 | |
| . | 00114 | | | | RSH AQ*24D | | 00107 | 03000 | 00030 | 00000 | |
| . | 00115 | | | | DIV W(SECSRAD) | | 00110 | 23030 | 01000 | 00000 | |
| . | 00116 | | | | STR Q*W(DLN4) | | 00111 | 14030 | 00662 | 00000 | |
| . | 00117 | | | | RSH AQ*30D | | 00112 | 03000 | 00036 | 00000 | |

FRACHTMAN*7/14/64

SUNTRACK

NOTES

TA STATEMENT

L1 ID LABEL

CARDS

LOC

F JKB Y

| CARDS | L1 ID LABEL | TA STATEMENT | LOC | F JKB Y | NOTES |
|-------|-------------|-----------------------|-------|---------|-------|
| • | 00120 | MUL W(SARAD) | 00113 | 22030 | 01001 |
| • | 00121 | LSH AQ*2*QP0S | 00114 | 07200 | 00002 |
| • | 00122 | ADD A*1 | 00115 | 20000 | 00001 |
| • | 00123 | STR A*W(DLN6) | 00116 | 15030 | 00665 |
| • | 00124 | ENT A*W(GMT2)*ANEG | 00117 | 11730 | 00712 |
| • | 00125 | JP \$+3 | 00120 | 61000 | 00123 |
| • | 00126 | ENT A*W(DLN2) | 00121 | 11030 | 00657 |
| • | 00127 | STR A*CPW(DLN2) | 00122 | 15070 | 00657 |
| • | 00130 | ENT A*W(CELTIME) | 00123 | 11030 | 63133 |
| • | 00131 | ENT Q*0*AP0S | 00124 | 10600 | 00000 |
| • | 00132 | CP A* | 00125 | 15040 | 00000 |
| • | 00133 | RSH AQ*26D | 00126 | 03000 | 00032 |
| • | 00134 | DIV W(HDAY) | 00127 | 23030 | 00775 |
| • | 00135 | STR Q*W(GMT2) | 00130 | 14030 | 00712 |
| • | 00136 | CL Q* | 00131 | 10000 | 00000 |
| • | 00137 | RSH AQ*23D | 00132 | 03000 | 00027 |
| • | 00140 | DIV W(MDAY) | 00133 | 23030 | 00776 |
| • | 00141 | STR Q*W(GMT4) | 00134 | 14030 | 00715 |
| • | 00142 | RSH AQ*30D | 00135 | 03000 | 00036 |
| • | 00143 | MUL W(SDAY) | 00136 | 22030 | 00777 |
| • | 00144 | LSH AQ*2*QP0S | 00137 | 07200 | 00002 |
| • | 00145 | ADD A*1 | 00140 | 20000 | 00001 |
| • | 00146 | STR A*W(GMT6) | 00141 | 15030 | 00720 |
| • | 00147 | ENT A*W(CELTIME)*ANEG | 00142 | 11730 | 63133 |
| • | 00150 | JP \$+3 | 00143 | 61000 | 00146 |
| • | 00151 | ENT A*W(GMT2) | 00144 | 11030 | 00712 |
| • | 00152 | STR A*CPW(GMT2) | 00145 | 15070 | 00712 |
| • | 00153 | ENT H4*L(DISTAD) | 00146 | 12410 | 01424 |
| • | 00154 | ENT A*L(DISTOFAD) | 00147 | 11010 | 01427 |
| • | 00155 | STR A*L(SETINTAD) | 00150 | 15010 | 01053 |
| • | 00156 | RJP INTERP0L | 00151 | 65000 | 01054 |
| • | 00157 | STR A*W(INITIAL18) | 00152 | 15030 | 00733 |
| • | 00160 | ENT A*W(JULIANDAY) | 00153 | 11030 | 01415 |
| • | 00161 | STR A*W(INITIAL3) | 00154 | 15030 | 00570 |
| • | 00162 | ENT A*L(DAY) | 00155 | 11010 | 63150 |
| • | 00163 | STR A*W(INITIAL12) | 00156 | 15030 | 00601 |
| • | 00164 | RJP U(INTERC0M) | 00157 | 65020 | 63426 |
| • | 00165 | U-TAG INITIALJD*0 | 00160 | 00560 | 00000 |
| • | 00166 | RJP U(INTERC0M) | 00161 | 65020 | 63426 |
| • | 00167 | U-TAG RGHTASC*0 | 00162 | 00602 | 00000 |

FRACHTMAN#7/14/64

SUNTRACK

| CARDS | LI | ID | LABEL | TA | STATEMENT | LOC | F | JKB | Y | NOTES |
|-------|-------|----|---------|----|--------------------|-------|-------|-----|-------|-------|
| | 00170 | | | | RJP U(INTERCØM) | 00163 | 65020 | | 63426 | |
| | 00171 | | | | U-TAG DLN*0 | 00164 | 00635 | | 00000 | |
| | 00172 | | | | RJP U(INTERCØM) | 00165 | 65020 | | 63426 | |
| | 00173 | | | | U-TAG INITIALDAT*0 | 00166 | 00571 | | 00000 | |
| | 00174 | | | | RJP U(INTERCØM) | 00167 | 65020 | | 63426 | |
| | 00175 | | | | U-TAG GMT*0 | 00170 | 00670 | | 00000 | |
| | 00176 | | | | RJP U(INTERCØM) | 00171 | 65020 | | 63426 | |
| | 00177 | | | | U-TAG INITIALDIS*0 | 00172 | 00723 | | 00000 | |
| | 00200 | | | | RJP U(INTERCØM) | 00173 | 65020 | | 63426 | |
| | 00201 | | | | U-TAG INITIALBØD*0 | 00174 | 00734 | | 00000 | |
| | 00202 | | AIRPØRT | | RPL Y+1*L(SUNINIT) | 00175 | 36010 | | 00002 | |
| | 00203 | | | | JP A | 00176 | 61070 | | 00000 | |
| | 00204 | | SUNCØNT | | ENTRY | 00177 | 61000 | | 00000 | |
| | 00205 | | | | RPL Y+1*L(SUNCØNT) | 00200 | 36010 | | 00177 | |
| | 00206 | | | | RJP DAYFIND | 00201 | 65000 | | 00274 | |
| | 00207 | | | | ENT B4*L(RAAD) | 00202 | 12410 | | 01422 | |
| | 00210 | | | | ENT A*L(RADIFAD) | 00203 | 11010 | | 01425 | |
| | 00211 | | | | STR A*L(SETINTAD) | 00204 | 15010 | | 01053 | |
| | 00212 | | | | RJP INTERPØL | 00205 | 65000 | | 01054 | |
| | 00213 | | | | RSH AQ*300 | 00206 | 03000 | | 00036 | |
| | 00214 | | | | MUL W(REVSRADIAN) | 00207 | 22030 | | 00764 | |
| | 00215 | | | | JP MØØSE*QPØS | 00210 | 60200 | | 00212 | |
| | 00216 | | | | ADD A*1 | 00211 | 20000 | | 00001 | |
| | 00217 | | MØØSE | | STR A*W(RA) | 00212 | 15030 | | 63002 | |
| | 00220 | | | | ENT Q*W(NUMDERIV) | 00213 | 10030 | | 01045 | |
| | 00221 | | | | MUL W(RDRSEC) | 00214 | 22030 | | 01003 | |
| | 00222 | | | | ENT B5*4 | 00215 | 12500 | | 00004 | |
| | 00223 | | | | RJP RØUNDØFF | 00216 | 65000 | | 01403 | |
| | 00224 | | | | STR A*W(RADØT) | 00217 | 15030 | | 63007 | |
| | 00225 | | | | ENT B4*L(DECAD) | 00220 | 12410 | | 01423 | |
| | 00226 | | | | ENT A*L(DECUIFAD) | 00221 | 11010 | | 01426 | |
| | 00227 | | | | STR A*L(SETINTAD) | 00222 | 15010 | | 01053 | |
| | 00230 | | | | RJP INTERPØL | 00223 | 65000 | | 01054 | |
| | 00231 | | | | RSH AQ*300 | 00224 | 03000 | | 00036 | |
| | 00232 | | | | MUL W(REVSRADIAN) | 00225 | 22030 | | 00764 | |
| | 00233 | | | | JP NEGDEC*ANEG | 00226 | 60700 | | 00505 | |
| | 00234 | | | | JP BEAVER*QPØS | 00227 | 60200 | | 00231 | |
| | 00235 | | | | ADD A*1 | 00230 | 20000 | | 00001 | |
| | 00236 | | BEAVER | | STR A*W(DEC) | 00231 | 15030 | | 63003 | |
| | 00237 | | | | ENT Q*W(NUMDERIV) | 00232 | 10030 | | 01045 | |

B37 RADS/SEC

FRACHTMAN*7/14/64

SUNTRACK

| CARDS | LI | ID | LABEL | TA | STATEMENT | LOC | F | JK | Y | NOTES |
|-------|----|-------|---------|----|------------------------|-------|-------|-------|---|--------------|
| | | | | | MUL W(RDRSEC) | 00233 | 22030 | 01003 | | |
| | | 00240 | | | ENT B5*4 | 00234 | 12500 | 00004 | | |
| | | 00241 | | | RJP R0UND0FF | 00235 | 65000 | 01403 | | |
| | | 00242 | | | STR A*W(DEC00T) | 00236 | 15030 | 63010 | | B37 RADS/SEC |
| | | 00243 | | | ENT B4*L(DISTAD) | 00237 | 12410 | 01424 | | |
| | | 00244 | | | ENT A*L(DISTDIFAD) | 00240 | 11010 | 01427 | | |
| | | 00245 | | | STR A*L(SETINTAD) | 00241 | 15010 | 01053 | | |
| | | 00246 | | | RJP INTERPOL | 00242 | 65000 | 01054 | | |
| | | 00247 | | | RSH AQ*4*QP0S | 00243 | 03200 | 00004 | | |
| | | 00250 | | | ADD A*1 | 00244 | 20000 | 00001 | | |
| | | 00251 | | | SUB A*W(SUNRAD) | 00245 | 21030 | 01005 | | |
| | | 00252 | | | CP A* | 00246 | 15040 | 00000 | | |
| | | 00253 | | | STR A*W(RADIUS) | 00247 | 15030 | 63006 | | |
| | | 00254 | | | ENT Q*W(NUMDERIV) | 00250 | 10030 | 01045 | | |
| | | 00255 | | | MUL W(AUDNMSEC) | 00251 | 22030 | 01002 | | |
| | | 00256 | | | ENT B5*7 | 00252 | 12500 | 00007 | | SUN |
| | | 00257 | | | RJP LEFRND0FF | 00253 | 65000 | 01373 | | |
| | | 00260 | | | STR A*W(RADIUS00T) | 00254 | 15030 | 63011 | | B24 NM/SEC |
| | | 00261 | | | EXIT | 00255 | 61010 | 00177 | | |
| | | 00262 | SEAP0RT | | CP A* | 00256 | 15040 | 00000 | | |
| | | 00263 | FLATNEG | | SUB A*W(HALFDAY)*AP0S | 00257 | 21630 | 00763 | | |
| | | 00264 | | | JP LESS0NE | 00260 | 61000 | 00272 | | |
| | | 00265 | | | RSH AQ*300 | 00261 | 03000 | 00036 | | |
| | | 00266 | | | DIV W(HALFDAY) | 00262 | 23030 | 00763 | | |
| | | 00267 | | | LSH AQ*300 | 00263 | 07000 | 00036 | | |
| | | 00270 | | | SUB A*1 | 00264 | 21000 | 00001 | | |
| | | 00271 | | | JP TW0LESS*AZER0 | 00265 | 60400 | 00270 | | |
| | | 00272 | | | JP TW0LESS*ANEG | 00266 | 60700 | 00270 | | |
| | | 00273 | | | ENT A*-3*SKIP | 00267 | 11140 | 77774 | | |
| | | 00274 | | | ENT A*-2 | 00270 | 11040 | 77775 | | |
| | | 00275 | TW0LESS | | JP ST0RE | 00271 | 61000 | 00334 | | |
| | | 00276 | | | ENT A*-1 | 00272 | 11040 | 77776 | | |
| | | 00277 | LESS0NE | | JP ST0RE | 00273 | 61000 | 00334 | | |
| | | 00300 | | | ENTRY | 00274 | 61000 | 00000 | | |
| | | 00301 | DAYFIND | | ENT A*W(CELTIME) | 00275 | 11030 | 63133 | | |
| | | 00302 | | | ADD A*W(DELTATEE)*AP0S | 00276 | 20630 | 63316 | | |
| | | 00303 | | | JP NEGTIME | 00277 | 61000 | 00311 | | |
| | | 00304 | | | LSH A*1*AP0S | 00300 | 06600 | 00001 | | |
| | | 00305 | | | SUB A*W(KEY)*SKIP | 00301 | 21130 | 01017 | | |
| | | 00306 | | | STR A*W(P)*SKIP | 00302 | 15130 | 01026 | | |
| | | 00307 | | | | | | | | |

FRACHIMAN#7/14/64

SUNTRACK

TA STATEMENT

LI ID LABEL

CARDS

NOTES

F JKB Y

LOC

STR A*W(P)*SKIP
ENT A*0*SKIP
ENT A*1
JP TIMESLIDE
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ØDAYINDEX
DAYINCRMT
NEGTIME00310
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00343LSH A*1*AP0S
SUB A*W(KEY)*SKIP
STR A*W(P)*SKIP
STR A*W(P)*SKIP
ENT A*-2*SKIP
ENT A*-1
STR A*W(DAYINDEX)
ENT A*W(CELTIME)*AP0S
JP FLATNEG
SUB A*W(HALFDAY)*AP0S
JP LESSONE
RSH AQ*
DIV W(HALFDAY)
LSH AQ*300
SUB A*1
JP CER0*AZER0
JP CER0*ANEG
ENT A*1*SKIP
ENT A*0
STR A*W(DAYINCRMT)
ADD A*W(WHOLEYEAR)
ADD A*2437300000310
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JD MAY 1 1963 GNMCH N00N

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00343STR Q*W(TAPEBL0CK)
STR Q*W(SL0TBL0CK)
ENT Q*W(SL0TBL0CK)
MUL 1100310
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FRACHTMAN*7/14/64

SUNTRACK

NOTES

F JKB Y

LOC

TA STATEMENT

LI ID LABEL

CARDS

| | | | | | | |
|-------|--------|-------------------|-------|-------|-------|--|
| 00357 | ADD | Q*AEPPHEM+200D | 00352 | 26000 | 02073 | |
| 00360 | STR | Q*L(RAAD) | 00353 | 14010 | 01422 | |
| 00361 | ADD | Q*1 | 00354 | 26000 | 00001 | |
| 00362 | STR | Q*L(RADIFAD) | 00355 | 14010 | 01425 | |
| 00363 | ADD | Q*1 | 00356 | 26000 | 00001 | |
| 00364 | STR | Q*L(DECAD) | 00357 | 14010 | 01423 | |
| 00365 | ADD | Q*1 | 00360 | 26000 | 00001 | |
| 00366 | STR | Q*L(DECIFAD) | 00361 | 14010 | 01426 | |
| 00367 | ADD | Q*1 | 00362 | 26000 | 00001 | |
| 00370 | STR | Q*L(DISTAD) | 00363 | 14010 | 01424 | |
| 00371 | ADD | Q*1 | 00364 | 26000 | 00001 | |
| 00372 | STR | Q*L(DISTIFAD) | 00365 | 14010 | 01427 | |
| 00373 | EXIT | | 00366 | 61010 | 00274 | |
| 00374 | ENTRY | | 00367 | 61000 | 00000 | |
| 00375 | STR | EPHEM*W(TAPSTAT) | 00370 | 17670 | 00502 | |
| 00376 | ENT | A*U(TAPSTAT) | 00371 | 11020 | 00502 | |
| 00377 | RSH | A*11D | 00372 | 02000 | 00013 | |
| 00400 | STR | A*W(TAPSTAT+1) | 00373 | 15030 | 00503 | |
| 00401 | RPL | Y+1*L(STATUSCK) | 00374 | 36010 | 00367 | |
| 00402 | ENT | B3*L(TAPSTAT+1) | 00375 | 12310 | 00503 | |
| 00403 | RIL | | 00376 | 60000 | 00000 | |
| 00404 | JP | STATACT+83 | 00377 | 61003 | 00400 | |
| 00405 | JP | BUST | 00400 | 61000 | 00454 | |
| 00406 | JP | BUST | 00401 | 61000 | 00454 | |
| 00407 | JP | BUST | 00402 | 61000 | 00454 | |
| 00410 | JP | BUST | 00403 | 61000 | 00454 | |
| 00411 | JP | BUST | 00404 | 61000 | 00454 | |
| 00412 | JP | BUST | 00405 | 61000 | 00454 | |
| 00413 | JP | BUST | 00406 | 61000 | 00454 | |
| 00414 | JP | BUST | 00407 | 61000 | 00454 | |
| 00415 | EXIT | | 00410 | 61010 | 00367 | |
| 00416 | JP | BUST | 00411 | 61000 | 00454 | |
| 00417 | JP | BUST | 00412 | 61000 | 00454 | |
| 00420 | JP | ENDFILE | 00413 | 61000 | 00450 | |
| 00421 | JP | CANTFIND | 00414 | 61000 | 00420 | |
| 00422 | JP | BUST | 00415 | 61000 | 00454 | |
| 00423 | JP | BUST | 00416 | 61000 | 00454 | |
| 00424 | JP | BUST | 00417 | 61000 | 00454 | |
| 00425 | EX-FCT | EPHEM*W(REWINDN0) | 00420 | 13670 | 00770 | |
| 00426 | ENT | B4*L(MONTHPRINT) | 00421 | 12410 | 00746 | |

4 SEQ ERR SYNC 20
 5 REWINDING 24
 6 CHAR COUNT 30
 7 ILLEGAL 34
 10 40 NORMAL
 11 REPEAT 44
 12 SEQ ERR COUNT 50
 13 EOF 54
 14 EOI 60
 15 NONSUCH
 16 ABN F C 70
 17 INTERLOCK 74

FRACHTMAN#7/14/64

SUNTRACK

| CARDS | LI | ID | LABEL | TA | STATEMENT | LDC | F | JKB | Y | NOTES |
|-------|-------|---------|-------|--------|-------------------|-------|-------|-------|---|-------|
| . | 00427 | | | ENT | A*(YEARPRINT+B4) | 00422 | 11034 | 01006 | | |
| . | 00430 | | | STR | A*(N0DATA2) | 00423 | 15030 | 00551 | | |
| . | 00431 | | | ENT | B4*L(YEARM0NTH) | 00424 | 12410 | 63147 | | |
| . | 00432 | | | ENT | A*(M0NTHPRINT+B4) | 00425 | 11034 | 00746 | | |
| . | 00433 | | | RPL | A+Y*(N0DATA2) | 00426 | 24030 | 00551 | | |
| . | 00434 | | | CL | A* | 00427 | 11000 | 00000 | | |
| . | 00435 | | | ENT | Q*L(BARRIER) | 00430 | 10010 | 00451 | | |
| . | 00436 | | | DIV | 12 | 00431 | 23000 | 00012 | | |
| . | 00437 | | | ADD | A*60 | 00432 | 20000 | 00060 | | |
| . | 00440 | | | STR | A*(IMPERIAL) | 00433 | 15020 | 01416 | | |
| . | 00441 | | | CL | A* | 00434 | 11000 | 00000 | | |
| . | 00442 | | | DIV | 12 | 00435 | 23000 | 00012 | | |
| . | 00443 | | | JP | ALBERT*AZER0 | 00436 | 60400 | 00440 | | |
| . | 00444 | | | ADD | A*60 | 00437 | 20000 | 00060 | | |
| . | 00445 | ALBERT | | LSH | A*6 | 00440 | 06000 | 00006 | | |
| . | 00446 | | | ADD | A*(IMPERIAL) | 00441 | 20020 | 01416 | | |
| . | 00447 | | | LSH | A*6 | 00442 | 06000 | 00006 | | |
| . | 00450 | | | ADD | A*310500005 | 00443 | 20030 | 03174 | | |
| . | 00451 | | | STR | A*(N0DATA3) | 00444 | 15030 | 00555 | | |
| . | 00452 | | | RJP | U(INTERCOM) | 00445 | 65020 | 63426 | | |
| . | 00453 | | | U-TAG | N0DATA*0 | 00446 | 00543 | 00000 | | |
| . | 00454 | | | JP | L(SUNINIT) | 00447 | 61010 | 00002 | | |
| . | 00455 | ENDFILE | | RPL | Y+1*L(IMPERIAL) | 00450 | 36010 | 01416 | | |
| . | 00456 | BARRIER | | SUB | A*11 | 00451 | 21000 | 00011 | | SUN |
| . | 00457 | | | JP | CANIFIND*AZER0 | 00452 | 60400 | 00420 | | |
| . | 00460 | | | JP | TRYAGAIN | 00453 | 61000 | 00034 | | |
| . | 00461 | BUST | | EX-FCT | EPHEM*(REWINDN0) | 00454 | 13670 | 00770 | | |
| . | 00462 | | | ENT | A*(TAPSTAT+1) | 00455 | 11010 | 00503 | | |
| . | 00463 | | | RSH | A*1 | 00456 | 02000 | 00001 | | |
| . | 00464 | | | ADD | A*60 | 00457 | 20000 | 00060 | | |
| . | 00465 | | | LSH | A*6 | 00460 | 06000 | 00006 | | |
| . | 00466 | | | STR | A*(TAPSTAT+2) | 00461 | 15010 | 00504 | | |
| . | 00467 | | | ENT | A*(TAPSTAT+1) | 00462 | 11010 | 00503 | | |
| . | 00470 | | | SEL | CL*X77776 | 00463 | 52040 | 77776 | | |
| . | 00471 | | | LSH | A*2 | 00464 | 06000 | 00002 | | |
| . | 00472 | | | ADD | A*60 | 00465 | 20000 | 00060 | | |
| . | 00473 | | | ADD | A*(TAPSTAT+2) | 00466 | 20010 | 00504 | | |
| . | 00474 | | | STR | A*(TAPEBUST1+3) | 00467 | 15010 | 00500 | | |
| . | 00475 | | | RJP | U(INTERCOM) | 00470 | 65020 | 63426 | | |
| . | 00476 | | | U-TAG | TAPEBUST*0 | 00471 | 00473 | 00000 | | |

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| CARDS | LI | ID | LABEL | TA | STATEMENT | SUNTRACK | LOC | F | JK | Y | NOTES |
|-------|-------|----|-----------|--------|-------------------------|----------|-------|-------|-------|---|-------|
| . | 00477 | | | JP | L(SUNINIT) | | 00472 | 61010 | 00002 | | |
| . | 00500 | | TAPEBUST | FD | 0*A | | 00473 | 06050 | 50505 | | |
| . | 00511 | | | -0 | TAPEBUST1 | | 00474 | 77777 | 00475 | | |
| . | 00502 | | TAPEBUST1 | FD | 0*IIIC | | 00475 | 16161 | 61005 | | |
| . | 00503 | | | FD | 0*STATU | | 00476 | 30310 | 63132 | | |
| . | 00504 | | | FD | 2*S SI | | 00477 | 30050 | 53061 | | |
| | | | | | | | 00500 | 05050 | 50505 | | |
| . | 00505 | | | -0 | -0 | | 00501 | 77777 | 77777 | | |
| . | 00506 | | TAPSTAT | +0 | | | 00502 | 00000 | 00000 | | |
| . | 00507 | | | +0 | | | 00503 | 00000 | 00000 | | |
| . | 00510 | | NEGDEC | +0 | | | 00504 | 00000 | 00000 | | |
| . | 00511 | | | JP | BEAVER=QNEG | | 00505 | 60300 | 00231 | | |
| . | 00512 | | | SUB | A*1 | | 00506 | 21000 | 00001 | | |
| . | 00513 | | | JP | BEAVER | | 00507 | 61000 | 00231 | | |
| . | 00514 | | N0TIN | ADD | A*1 | | 00510 | 20000 | 00001 | | |
| . | 00515 | | | SUB | A*W(SL0TBL0CK) | | 00511 | 21030 | 01420 | | |
| . | 00516 | | | JP | BL0CKAY*AP0S | | 00512 | 60600 | 00530 | | |
| . | 00517 | | BL0CKCEE | IN | EPHEM*W(EPHEMB) | | 00513 | 73670 | 00541 | | |
| . | 00520 | | | N0-0P | | | 00514 | 12000 | 00000 | | |
| . | 00521 | | | EX-FCT | EPHEM*W(SRHIBIN) | | 00515 | 13670 | 00765 | | |
| . | 00522 | | | N0-0P | | | 00516 | 12000 | 00000 | | |
| . | 00523 | | | EX-FCT | EPHEM*W(TAPESEARCH) | | 00517 | 13670 | 01421 | | |
| . | 00524 | | | JP | \$ | | 00520 | 61000 | 00520 | | |
| . | 00525 | | | IN | EPHEM*W(EPHEMC) | | 00521 | 73670 | 00542 | | |
| . | 00526 | | PATCH | ENT | A*40 | | 00522 | 11000 | 00040 | | |
| . | 00527 | | | EX-FCT | EPHEM*W(SRHIBIN) | | 00523 | 13670 | 00765 | | |
| . | 00530 | | | RPL | A+Y*W(TAPESEARCH) | | 00524 | 24030 | 01421 | | |
| . | 00531 | | | EX-FCT | EPHEM*W(TAPESEARCH) | | 00525 | 13670 | 01421 | | |
| . | 00532 | | | JP | \$ | | 00526 | 61000 | 00526 | | |
| . | 00533 | | | JP | N0RMAL | | 00527 | 61000 | 00050 | | |
| . | 00534 | | BL0CKAY | IN | EPHEM*W(EPHEMA) | | 00530 | 73670 | 00540 | | |
| . | 00535 | | | ENT | A*-40 | | 00531 | 11040 | 77737 | | |
| . | 00536 | | | EX-FCT | EPHEM*W(SRHIBIN) | | 00532 | 13670 | 00765 | | |
| . | 00537 | | | RPL | A+Y*W(TAPESEARCH) | | 00533 | 24030 | 01421 | | |
| . | 00540 | | | EX-FCT | EPHEM*W(TAPESEARCH) | | 00534 | 13670 | 01421 | | |
| . | 00541 | | | JP | \$ | | 00535 | 61000 | 00535 | | |
| . | 00542 | | | IN | EPHEM*W(EPHEMB) | | 00536 | 73670 | 00541 | | |
| . | 00543 | | | JP | PATCH | | 00537 | 61000 | 00522 | | |
| . | 00544 | | EPHEMA | U-TAG | AEPHEM+287D*AEPHEM | | 00540 | 02070 | 01431 | | |
| . | 00545 | | EPHEMB | U-TAG | AEPHEM+575D*AEPHEM+288D | | 00541 | 02530 | 02071 | | |

FRACHIMAN*7/14/64

SUNTRACK

| CARDS | LI | ID | LABEL | TA | STATEMENT | LOC | F | JKB | Y | NOTES |
|-------|-------|----|------------|----|---------------------------|-------|---|-------|-------|-------|
| . | 00546 | | EPHEMC | | U-TAG | 00542 | | 03170 | 02531 | |
| . | 00547 | | N0DATA | | FD 0*A | 00543 | | 06050 | 50505 | |
| . | 00550 | | | | -0 N0DATA1 | 00544 | | 77777 | 00545 | |
| . | 00551 | | N0DATA1 | | FD 0*SUN E | 00545 | | 30322 | 30512 | |
| . | 00552 | | | | FD 0*PHEME | 00546 | | 25151 | 22212 | |
| . | 00553 | | | | FD 0*PHEME | 00547 | | 27163 | 00513 | |
| . | 00554 | | | | FD 0*PHEME | 00550 | | 24270 | 50505 | |
| . | 00555 | | N0DATA2 | | FD 0*63/63 | 00551 | | 66637 | 46663 | |
| . | 00556 | | | | FD 0* N0T | 00552 | | 05232 | 43105 | |
| . | 00557 | | | | FD 0*AMONG | 00553 | | 06222 | 42314 | |
| . | 00560 | | | | FD 0* FIRS | 00554 | | 05131 | 62730 | |
| . | 00561 | | N0DATA3 | | FD 0* T | 00555 | | 31050 | 50505 | |
| . | 00562 | | | | FD 0*FILES | 00556 | | 13162 | 11230 | |
| . | 00563 | | | | -0 | 00557 | | 77777 | 77777 | |
| . | 00564 | | INITIALJD | | FD 0*A | 00560 | | 06050 | 50505 | |
| . | 00565 | | | | U-TAG INITIAL2*INITIAL1 | 00561 | | 00566 | 00562 | |
| . | 00566 | | INITIAL1 | | FD 0*JULIA | 00562 | | 17322 | 11606 | |
| . | 00567 | | | | FD 2*N DAY | 00563 | | 23051 | 10636 | |
| . | 00570 | | | | -0 | 00564 | | 05050 | 50505 | |
| . | 00571 | | INITIAL2 | | FD 0*D | 00565 | | 77777 | 77777 | |
| . | 00572 | | | | -0 INITIAL3 | 00566 | | 11050 | 50505 | |
| . | 00573 | | INITIAL3 | | 0 | 00567 | | 77777 | 00570 | |
| . | 00574 | | INITIALDAT | | FD 0*A | 00570 | | 00000 | 00000 | |
| . | 00575 | | | | U-TAG INITIAL11*INITIAL10 | 00571 | | 06050 | 50505 | |
| . | 00576 | | INITIAL10 | | FD 3*DAY 0F YEAR | 00572 | | 00577 | 00573 | |
| . | 00577 | | | | -0 | 00573 | | 11063 | 60524 | |
| . | 00600 | | INITIAL11 | | FD 0*D | 00574 | | 13053 | 61206 | |
| . | 00601 | | | | -0 INITIAL12 | 00575 | | 27050 | 50505 | |
| . | 00602 | | INITIAL12 | | 0 | 00576 | | 77777 | 77777 | |
| . | 00603 | | RGHTASC | | FD 0*A | 00577 | | 11050 | 50505 | |
| . | 00604 | | | | 0 RAL | 00600 | | 77777 | 00601 | |
| . | 00605 | | | | 0 0 | 00601 | | 00000 | 00000 | |
| . | 00606 | | | | FD 0 | 00602 | | 06050 | 50505 | |
| . | 00607 | | | | 0 0 | 00603 | | 00000 | 00620 | |
| . | 00610 | | | | FD 0*A | 00604 | | 11050 | 50505 | |
| . | 00611 | | | | 0 RA1 | 00605 | | 00000 | 00624 | |
| . | 00612 | | | | 0 RA2 | 00606 | | 06050 | 50505 | |
| . | | | | | FD 0*A | 00607 | | 00000 | 00625 | |
| . | | | | | 0 RA3 | 00610 | | 11050 | 50505 | |
| . | | | | | FD 0*D | 00611 | | 00000 | 00627 | |
| . | | | | | 0 RA4 | 00612 | | 00000 | 00627 | |

FRACHTMAN*7/14/64

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| CARDS | LI | ID | LABEL | TA | STATEMENT | LUC | F | JKB | Y | NOTES |
|-------|-------|------|-------|------|---------------|-------|-------|-----|-------|-------|
| . | 00613 | | | FD | 0*A | 00612 | 06050 | | 50505 | |
| . | 00614 | | | 0 | RA5 | 00613 | 00000 | | 00630 | |
| . | 00615 | | | FD | 0*X2B23 | 00614 | 35620 | | 76263 | |
| . | 00616 | | | 0 | RA6 | 00615 | 00000 | | 00632 | |
| . | 00617 | | | FD | 0*A | 00616 | 06050 | | 50505 | |
| . | 00620 | | | -0 | RA7 | 00617 | 77777 | | 00633 | |
| . | 00621 | RA1 | | FD | 3*RIGHT ASC | 00620 | 27161 | | 41531 | |
| | | | | | | 00621 | 05063 | | 01005 | |
| | | | | | | 00622 | 05050 | | 50505 | |
| | | | | | | 00623 | 77777 | | 77777 | |
| | 00622 | | | -0 | | 00624 | 00000 | | 00000 | |
| . | 00623 | RA2 | | 0 | | 00625 | 00000 | | 01505 | |
| . | 00624 | RA3 | | 1505 | | 00626 | 77777 | | 77777 | |
| . | 00625 | | | -0 | | 00627 | 00000 | | 00000 | |
| . | 00626 | RA4 | | 0 | | 00630 | 00000 | | 02205 | |
| . | 00627 | RA5 | | 2205 | | 00631 | 77777 | | 77777 | |
| . | 00630 | | | -0 | | 00632 | 00000 | | 00000 | |
| . | 00631 | RA6 | | 0 | | 00633 | 00000 | | 00030 | |
| . | 00632 | RA7 | | 30 | | 00634 | 77777 | | 77777 | |
| . | 00633 | | | -0 | | 00635 | 06050 | | 50505 | |
| . | 00634 | DLN | | FD | 0*A | 00636 | 00000 | | 00653 | |
| . | 00635 | | | 0 | DLN1 | 00637 | 11050 | | 50505 | |
| . | 00636 | | | FD | 0*D | 00640 | 00000 | | 00657 | |
| . | 00637 | | | 0 | DLN2 | 00641 | 06050 | | 50505 | |
| . | 00640 | | | FD | 0*A | 00642 | 00000 | | 00660 | |
| . | 00641 | | | 0 | DLN3 | 00643 | 11050 | | 50505 | |
| . | 00642 | | | FD | 0*D | 00644 | 00000 | | 00662 | |
| . | 00643 | | | 0 | DLN4 | 00645 | 06050 | | 50505 | |
| . | 00644 | | | FD | 0*A | 00646 | 00000 | | 00663 | |
| . | 00645 | | | 0 | DLN5 | 00647 | 35620 | | 76263 | |
| . | 00646 | | | FD | 0*X2B23 | 00650 | 00000 | | 00665 | |
| . | 00647 | | | 0 | DLN6 | 00651 | 06050 | | 50505 | |
| . | 00650 | | | FD | 0*A | 00652 | 77777 | | 00666 | |
| . | 00651 | | | -0 | DLN7 | 00653 | 11121 | | 02116 | |
| . | 00652 | DLN1 | | FD | 3*DECLINATION | 00654 | 23063 | | 11624 | |
| | | | | | | 00655 | 23050 | | 50505 | |
| . | 00653 | | | -0 | | 00656 | 77777 | | 77777 | |
| . | 00654 | DLN2 | | 0 | | 00657 | 00000 | | 00000 | |
| . | 00655 | DLN3 | | 1105 | | 00660 | 00000 | | 01105 | |
| . | 00656 | | | -0 | | 00661 | 77777 | | 77777 | |

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NOTES

TA STATEMENT

LI ID LABEL

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| | | | | | | | | | |
|-------|------------|-------|---------------------|--|-------|-------|-------|--|--|
| 00657 | DLN4 | 0 | | | 00662 | 00000 | 00000 | | |
| 00660 | DLN5 | 7205 | | | 00663 | 00000 | 07205 | | |
| 00661 | | -0 | | | 00664 | 77777 | 77777 | | |
| 00662 | DLN6 | 0 | | | 00665 | 00000 | 00000 | | |
| 00663 | DLN7 | 52 | | | 00666 | 00000 | 00052 | | |
| 00664 | | -0 | | | 00667 | 77777 | 77777 | | |
| 00665 | GMT | | 0*A | | 00670 | 06050 | 50505 | | |
| 00666 | | 0 | GMT1 | | 00671 | 00000 | 00706 | | |
| 00667 | | FD | 0*D | | 00672 | 11050 | 50505 | | |
| 00670 | | 0 | GMT2 | | 00673 | 00000 | 00712 | | |
| 00671 | | FD | 0*A | | 00674 | 06050 | 50505 | | |
| 00672 | | 0 | GMT3 | | 00675 | 00000 | 00713 | | |
| 00673 | | FD | 0*D | | 00676 | 11050 | 50505 | | |
| 00674 | | 0 | GMT4 | | 00677 | 00000 | 00715 | | |
| 00675 | | FD | 0*A | | 00700 | 06050 | 50505 | | |
| 00676 | | 0 | GMT5 | | 00701 | 00000 | 00716 | | |
| 00677 | | FD | 0*X2B23 | | 00702 | 35620 | 76263 | | |
| 00700 | | 0 | GMT6 | | 00703 | 00000 | 00720 | | |
| 00701 | | FD | 0*A | | 00704 | 06050 | 50505 | | |
| 00702 | | -0 | GMT7 | | 00705 | 77777 | 00721 | | |
| 00703 | GMT1 | FD | 3*UNIVERSAL TIME | | 00706 | 32231 | 63312 | | |
| | | | | | 00707 | 27300 | 62105 | | |
| | | | | | 00710 | 31162 | 21205 | | |
| | | | | | 00711 | 77777 | 77777 | | |
| 00704 | | -0 | | | 00712 | 00000 | 00000 | | |
| 00705 | GMT2 | 0 | | | 00713 | 00000 | 01505 | | |
| 00706 | GMT3 | 1505 | | | 00714 | 77777 | 77777 | | |
| 00707 | | -0 | | | 00715 | 00000 | 00000 | | |
| 00710 | GMT4 | 0 | | | 00716 | 00000 | 02205 | | |
| 00711 | GMT5 | 2205 | | | 00717 | 77777 | 77777 | | |
| 00712 | | -0 | | | 00720 | 00000 | 00000 | | |
| 00713 | GMT6 | 0 | | | 00721 | 00000 | 00030 | | |
| 00714 | GMT7 | 30 | | | 00722 | 77777 | 77777 | | |
| 00715 | | -0 | | | 00723 | 06050 | 50505 | | |
| 00716 | INITIALDIS | FD | 0*A | | 00724 | 00731 | 00725 | | |
| 00717 | | U-TAG | INITIAL17*INITIAL16 | | 00725 | 11163 | 03106 | | |
| 00720 | INITIAL16 | FD | 0*DISTA | | 00726 | 23101 | 20505 | | |
| 00721 | | FD | 0*NCE | | 00727 | 06053 | 20505 | | |
| 00722 | | FD | 0*A U | | 00730 | 77777 | 77777 | | |
| 00723 | | -0 | | | 00731 | 35700 | 76270 | | |
| 00724 | INITIAL17 | FD | 0*X8828 | | | | | | |

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| CARDS | LI | ID | LABEL | TA | STATEMENT | LOC | F | JKB | Y | NOTES | |
|-------|--------|----|-----------|-------|------------|--------|-------|--------|---|-------------------|---------------------|
| . | 007767 | | MDAY | 26602 | 2660266026 | 007776 | 26602 | 66026 | | 24 832 DEC | 711111111829 2E |
| . | 007770 | | SDAY | 25060 | 000000 | 007777 | 25060 | 000000 | | 10/1440 DEC | 86400.000812 |
| . | 007771 | | SECSRAD | 23040 | 45527 | 010000 | 23040 | 45527 | | DEC | .59573905829 2E |
| . | 007772 | | SARAD | 31133 | 43172 | 010001 | 31133 | 43172 | | 13PI/43200 DEC | 206264.81811 64 |
| . | 007773 | | AUDNMSEC | 35156 | 43656 | 010002 | 35156 | 43656 | | 800/PI DEC | 934.91819 |
| . | 007774 | | RDRSEC | 30213 | 44241 | 010003 | 30213 | 44241 | | DEC | .75851852829 2E1 |
| . | 007775 | | TW0PIE | 31103 | 75523 | 010004 | 31103 | 75523 | | 6/86400 DEC | 6.2831853826 |
| . | 007776 | | SUNRAD | 00002 | 30432 | 010005 | 00002 | 30432 | | DEC | .0046555824 SUN 696 |
| . | 007777 | | YEARPRINT | 00007 | 46661 | 010006 | 00007 | 46661 | | | |
| . | 010000 | | | 00007 | 46662 | 010007 | 00007 | 46662 | | | |
| . | 010001 | | | 00007 | 46663 | 010010 | 00007 | 46663 | | | |
| . | 010002 | | | 00007 | 46664 | 010011 | 00007 | 46664 | | | |
| . | 010003 | | | 00007 | 46665 | 010012 | 00007 | 46665 | | | |
| . | 010004 | | | 00007 | 46666 | 010013 | 00007 | 46666 | | | |
| . | 010005 | | | 00007 | 46667 | 010014 | 00007 | 46667 | | | |
| . | 010006 | | | 00007 | 46670 | 010015 | 00007 | 46670 | | | |
| . | 010007 | | | 00007 | 46671 | 010016 | 00007 | 46671 | | | |
| . | 010010 | | KEY | 40000 | 000000 | 010017 | 40000 | 000000 | | | |
| . | 010011 | | FIRSTDIFF | 0 | | 010020 | 00000 | 000000 | | | |
| . | 010012 | | BETA | 0 | | 010021 | 00000 | 000000 | | | |
| . | 010013 | | GAMMA | 0 | | 010022 | 00000 | 000000 | | | |
| . | 010014 | | DELTA | 0 | | 010023 | 00000 | 000000 | | | |
| . | 010015 | | EPSILON | 0 | | 010024 | 00000 | 000000 | | | |
| . | 010016 | | FUNCTION | 0 | | 010025 | 00000 | 000000 | | | |
| . | 010017 | | P | 0 | | 010026 | 00000 | 000000 | | | |
| . | 010020 | | HALF | 20000 | 000000 | 010027 | 20000 | 000000 | | | |
| . | 010021 | | DMINB | 0 | | 010030 | 00000 | 000000 | | | |
| . | 010022 | | DMIN2CPL3 | 0 | | 010031 | 00000 | 000000 | | | |
| . | 010023 | | EP2BM2DMA | 0 | | 010032 | 00000 | 000000 | | | |
| . | 010024 | | BESSEL | 0 | | 010033 | 00000 | 000000 | | | |
| . | 010025 | | | 0 | | 010034 | 00000 | 000000 | | | |

FRACHTMAN*7/14/64

SUNTRACK

NOTES

TA STATEMENT

LI ID LABEL

CARDS

F JKB Y

LUC

| CARDS | LI | ID | LABEL | TA STATEMENT | F | JKB | Y | LUC | NOTES |
|-------|-------|----|----------|--------------|-------|-------|-------|-------|-------|
| . | 01026 | | | | 00000 | 00000 | 00000 | 01035 | |
| . | 01027 | | | | 00000 | 00000 | 00000 | 01036 | |
| . | 01030 | | | | 00000 | 00000 | 00000 | 01037 | |
| . | 01031 | | PSQMP | | 00000 | 00000 | 00000 | 01040 | |
| . | 01032 | | PSQMP6 | | 00000 | 00000 | 00000 | 01041 | |
| . | 01033 | | THIRD | | 00000 | 00000 | 00000 | 01042 | |
| . | 01034 | | SIXTH | | 00000 | 00000 | 00000 | 01043 | |
| . | 01035 | | KENNEDY | | 00000 | 00000 | 00000 | 01044 | |
| . | 01036 | | NUMBERIV | | 00000 | 00000 | 00000 | 01045 | |
| . | 01037 | | F8ESSEL | | 00000 | 00000 | 00000 | 01046 | |
| . | 01040 | | | | 00000 | 00000 | 00000 | 01047 | |
| . | 01041 | | | | 00000 | 00000 | 00000 | 01050 | |
| . | 01042 | | | | 00000 | 00000 | 00000 | 01051 | |
| . | 01043 | | | | 00000 | 00000 | 00000 | 01052 | |
| . | 01044 | | SETINTAD | | 00000 | 00000 | 00000 | 01053 | |
| . | 01045 | | INTERP0L | | 00000 | 00000 | 00000 | 01054 | |
| . | 01046 | | | | 00000 | 00000 | 00000 | 01055 | |
| . | 01047 | | | | 00000 | 00000 | 00000 | 01056 | |
| . | 01050 | | | | 00000 | 00000 | 00000 | 01057 | |
| . | 01051 | | | | 00000 | 00000 | 00000 | 01060 | |
| . | 01052 | | | | 00000 | 00000 | 00000 | 01061 | |
| . | 01053 | | | | 00000 | 00000 | 00000 | 01062 | |
| . | 01054 | | | | 00000 | 00000 | 00000 | 01063 | |
| . | 01055 | | | | 00000 | 00000 | 00000 | 01064 | |
| . | 01056 | | | | 00000 | 00000 | 00000 | 01065 | |
| . | 01057 | | | | 00000 | 00000 | 00000 | 01066 | |
| . | 01060 | | | | 00000 | 00000 | 00000 | 01067 | |
| . | 01061 | | | | 00000 | 00000 | 00000 | 01070 | |
| . | 01062 | | | | 00000 | 00000 | 00000 | 01071 | |
| . | 01063 | | | | 00000 | 00000 | 00000 | 01072 | |
| . | 01064 | | | | 00000 | 00000 | 00000 | 01073 | |
| . | 01065 | | | | 00000 | 00000 | 00000 | 01074 | |
| . | 01066 | | | | 00000 | 00000 | 00000 | 01075 | |
| . | 01067 | | | | 00000 | 00000 | 00000 | 01076 | |
| . | 01070 | | | | 00000 | 00000 | 00000 | 01077 | |
| . | 01071 | | | | 00000 | 00000 | 00000 | 01100 | |
| . | 01072 | | | | 00000 | 00000 | 00000 | 01101 | |
| . | 01073 | | | | 00000 | 00000 | 00000 | 01102 | |
| . | 01074 | | | | 00000 | 00000 | 00000 | 01103 | |
| . | 01075 | | | | 00000 | 00000 | 00000 | 01104 | |

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| CARDS | L1 ID LABEL | TA STATEMENT | LUC | F | JKB Y | NOTES |
|-------|-------------|-------------------------|-------|-------|-------|-------|
| • | 01076 | SUB A*(FIRSTDIFF) | 01105 | 21030 | 01020 | |
| • | 01077 | SUB A*(W(BESSEL) | 01106 | 21030 | 01033 | |
| • | 01100 | STR A*(W(EP2BM2DMA) | 01107 | 15030 | 01032 | |
| • | 01101 | ENT Q*(W(P) | 01110 | 10030 | 01026 | |
| • | 01102 | MUL W(GAMMA) | 01111 | 22030 | 01022 | |
| • | 01103 | LSH AQ*1 | 01112 | 07000 | 00001 | |
| • | 01104 | STR A*(W(BESSEL+1) | 01113 | 15030 | 01034 | |
| • | 01105 | STR A*(W(BESSEL)*AP0S | 01114 | 15630 | 01033 | |
| • | 01106 | JP NEGBESS1 | 01115 | 61000 | 01357 | |
| • | 01107 | LSH AQ*290 | 01116 | 07000 | 00035 | |
| • | 01110 | SEL CL*(W(KEY) | 01117 | 52030 | 01017 | |
| • | 01111 | STR A*(W(FBESSEL) | 01120 | 15030 | 01046 | |
| • | 01112 | STR A*(W(FBESSEL+1) | 01121 | 15030 | 01047 | |
| • | 01113 | ENT Q*(W(P) | 01122 | 10030 | 01026 | |
| • | 01114 | MUL W(P) | 01123 | 22030 | 01026 | |
| • | 01115 | ENT B5*1 | 01124 | 12500 | 00001 | |
| • | 01116 | RJP LEFRND0FF | 01125 | 65000 | 01373 | |
| • | 01117 | SUB A*(W(P) | 01126 | 21030 | 01026 | |
| • | 01120 | STR A*(W(PSQMP) | 01127 | 15030 | 01040 | |
| • | 01121 | RSH AQ*300 | 01130 | 03000 | 00036 | |
| • | 01122 | MUL W(DMINB) | 01131 | 22030 | 01030 | |
| • | 01123 | RSH AQ*1 | 01132 | 03000 | 00001 | |
| • | 01124 | STR A*(W(BESSEL+2)*AP0S | 01133 | 15630 | 01035 | |
| • | 01125 | JP NEGBESS2 | 01134 | 61000 | 01362 | |
| • | 01126 | LSH AQ*290 | 01135 | 07000 | 00035 | |
| • | 01127 | SEL CL*(W(KEY) | 01136 | 52030 | 01017 | |
| • | 01130 | STR A*(W(FBESSEL+2) | 01137 | 15030 | 01050 | |
| • | 01131 | ENT A*(W(PSQMP) | 01140 | 11030 | 01040 | |
| • | 01132 | RSH AQ*300 | 01141 | 03000 | 00036 | |
| • | 01133 | DIV 6*AZER0 | 01142 | 23400 | 00006 | |
| • | 01134 | JP REMAINDER | 01143 | 61000 | 01257 | |
| • | 01135 | STR Q*(W(PSQMP6) | 01144 | 14030 | 01041 | |
| • | 01136 | ENT Q*(W(P) | 01145 | 10030 | 01026 | |
| • | 01137 | SUB Q*(W(HALF) | 01146 | 27030 | 01027 | |
| • | 01140 | MUL W(PSQMP6) | 01147 | 22030 | 01041 | |
| • | 01141 | RJP LEFRND0FF | 01150 | 65000 | 01373 | |
| • | 01142 | RSH AQ*300 | 01151 | 03000 | 00036 | |
| • | 01143 | MUL W(DMIN2CPLB) | 01152 | 22030 | 01031 | |
| • | 01144 | LSH AQ*1 | 01153 | 07000 | 00001 | |
| • | 01145 | STR A*(W(BESSEL+3)*AP0S | 01154 | 15630 | 01036 | |

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| CARDS | LI | ID | LABEL | TA | STATEMENT | LOC | F | JKB | Y | NOTES |
|-------|-------|--------|-------|-----|---------------------|-------|-------|-------|---|-------|
| . | 01146 | | | JP | NEGBESS3 | 01155 | 61000 | 01365 | | |
| . | 01147 | | | LSH | AQ*29D | 01156 | 07000 | 00035 | | |
| . | 01150 | | | SEL | CL*W(KEY) | 01157 | 52030 | 01017 | | |
| . | 01151 | ST0R3 | | STR | A*W(FBESSEL+3) | 01160 | 15030 | 01051 | | |
| . | 01152 | | | ENT | A*W(EP2BM2DMA)*ANOT | 01161 | 11530 | 01032 | | |
| . | 01153 | | | JP | NØFØURTH | 01162 | 61000 | 01252 | | |
| . | 01154 | | | ENT | Q*W(PSQMP6) | 01163 | 10030 | 01041 | | |
| . | 01155 | | | SUB | Q*W(THIRD) | 01164 | 27030 | 01042 | | |
| . | 01156 | | | MUL | W(PSQMP) | 01165 | 22030 | 01040 | | |
| . | 01157 | | | RJP | LEFRNDØFF | 01166 | 65000 | 01373 | | |
| . | 01160 | | | RSH | AQ*30D | 01167 | 03000 | 00036 | | |
| . | 01161 | | | MUL | W(EP2BM2DMA) | 01170 | 22030 | 01032 | | |
| . | 01162 | | | RSH | AQ*2 | 01171 | 03000 | 00002 | | |
| . | 01163 | | | STR | A*W(BESSEL+4)*APØS | 01172 | 15630 | 01037 | | |
| . | 01164 | | | JP | NEGBESS4 | 01173 | 61000 | 01370 | | |
| . | 01165 | | | LSH | AQ*29D | 01174 | 07000 | 00035 | | |
| . | 01166 | | | SEL | CL*W(KEY) | 01175 | 52030 | 01017 | | |
| . | 01167 | STØR4 | | STR | A*W(FBESSEL+4) | 01176 | 15030 | 01052 | | |
| . | 01170 | | | ENT | A*W(FBESSEL) | 01177 | 11030 | 01046 | | |
| . | 01171 | | | SEL | CP*W(FBESSEL+2) | 01200 | 51030 | 01050 | | |
| . | 01172 | | | JP | FLØTEST1*APØS | 01201 | 60600 | 01271 | | |
| . | 01173 | NØFLØ1 | | ENT | Q*W(BESSEL+2) | 01202 | 10030 | 01035 | | |
| . | 01174 | FIX1 | | RPL | Y+Q*W(BESSEL) | 01203 | 34030 | 01033 | | |
| . | 01175 | | | ENT | A*W(FBESSEL+2) | 01204 | 11030 | 01050 | | |
| . | 01176 | | | RPL | A+Y*W(FBESSEL) | 01205 | 24030 | 01046 | | |
| . | 01177 | | | SEL | CP*W(FBESSEL+3) | 01206 | 51030 | 01051 | | |
| . | 01200 | | | JP | FLØTEST2*APØS | 01207 | 60600 | 01313 | | |
| . | 01201 | NØFLØ2 | | ENT | Q*W(BESSEL+3) | 01210 | 10030 | 01036 | | |
| . | 01202 | FIX2 | | RPL | Y+Q*W(BESSEL) | 01211 | 34030 | 01033 | | |
| . | 01203 | | | ENT | A*W(FBESSEL+3) | 01212 | 11030 | 01051 | | |
| . | 01204 | | | RPL | A+Y*W(FBESSEL) | 01213 | 24030 | 01046 | | |
| . | 01205 | | | SEL | CP*W(FBESSEL+4) | 01214 | 51030 | 01052 | | |
| . | 01206 | | | JP | FLØTEST3*APØS | 01215 | 60600 | 01335 | | |
| . | 01207 | NØFLØ3 | | ENT | Q*W(BESSEL+4) | 01216 | 10030 | 01037 | | |
| . | 01210 | FIX3 | | RPL | Y+Q*W(BESSEL) | 01217 | 34030 | 01033 | | |
| . | 01211 | | | ENT | A*W(FBESSEL+4) | 01220 | 11030 | 01052 | | |
| . | 01212 | | | RPL | A+Y*W(FBESSEL) | 01221 | 24030 | 01046 | | |
| . | 01213 | | | ENT | Q*W(P) | 01222 | 10030 | 01026 | | |
| . | 01214 | | | SUB | Q*W(HALF) | 01223 | 27030 | 01027 | | |
| . | 01215 | | | MUL | W(DMINB) | 01224 | 22030 | 01030 | | |

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| CARDS | LI | ID LABEL | TA STATEMENT | LOC | F | JKB Y | NOTES |
|-------|-------|----------|---------------------|-------|-------|-------|-------|
| . | 01216 | CL | B5* | 01225 | 12500 | 00000 | |
| . | 01217 | RJP | LEFRND0FF | 01226 | 65000 | 01373 | |
| . | 01220 | STR | A*W(KENNEDY) | 01227 | 15030 | 01044 | |
| . | 01221 | ENT | Q*W(PSQMP) | 01230 | 10030 | 01040 | |
| . | 01222 | ADD | Q*W(SIXTH) | 01231 | 26030 | 01043 | |
| . | 01223 | MUL | W(DMIN2CPLB) | 01232 | 22030 | 01031 | |
| . | 01224 | RJP | LEFRND0FF | 01233 | 65000 | 01373 | |
| . | 01225 | ADD | A*W(KENNEDY) | 01234 | 20030 | 01044 | |
| . | 01226 | ADD | A*W(GAMMA) | 01235 | 20030 | 01022 | |
| . | 01227 | STR | A*W(NUMDERIV) | 01236 | 15030 | 01045 | |
| . | 01230 | ENT | A*W(FBESSEL)*AP0S | 01237 | 11630 | 01046 | |
| . | 01231 | JP | MINUS | 01240 | 61000 | 01246 | |
| . | 01232 | LSH | A*1*ANEG | 01241 | 06700 | 00001 | |
| . | 01233 | ENT | A*W(BESSEL)*SKIP | 01242 | 11130 | 01033 | |
| . | 01234 | RPL | Y+1*W(BESSEL) | 01243 | 36030 | 01033 | |
| . | 01235 | ADD | A*W(0+B4) | 01244 | 20034 | 00000 | |
| . | 01236 | EXIT | | 01245 | 61010 | 01054 | |
| . | 01237 | LSH | A*1*AP0S | 01246 | 06600 | 00001 | |
| . | 01240 | ENT | A*W(BESSEL)*SKIP | 01247 | 11130 | 01033 | |
| . | 01241 | RPL | Y-1*W(BESSEL) | 01250 | 37030 | 01033 | |
| . | 01242 | JP | SUM | 01251 | 61000 | 01244 | |
| . | 01243 | CL | A* | 01252 | 11000 | 00000 | |
| . | 01244 | STR | A*W(BESSEL+4) | 01253 | 15030 | 01037 | |
| . | 01245 | JP | ST0R4 | 01254 | 61000 | 01176 | |
| . | 01246 | STR | Q*W(EP2BM2DMA) | 01255 | 14030 | 01032 | |
| . | 01247 | JP | PARTIAL | 01256 | 61000 | 01110 | |
| . | 01250 | JP | CIVIL*QP0S | 01257 | 60200 | 01265 | |
| . | 01251 | STR | A*A | 01260 | 15040 | 00000 | |
| . | 01252 | SUB | A*3*AP0S | 01261 | 21600 | 00003 | |
| . | 01253 | JP | LINC0LN | 01262 | 61000 | 01144 | |
| . | 01254 | SUB | Q*1 | 01263 | 27000 | 00001 | |
| . | 01255 | JP | LINC0LN | 01264 | 61000 | 01144 | |
| . | 01256 | SUB | A*3*AP0S | 01265 | 21600 | 00003 | |
| . | 01257 | JP | LINC0LN | 01266 | 61000 | 01144 | |
| . | 01260 | ADD | Q*1 | 01267 | 26000 | 00001 | |
| . | 01261 | JP | LINC0LN | 01270 | 61000 | 01144 | |
| . | 01262 | ENT | A*W(FBESSEL)*ANEG | 01271 | 11730 | 01046 | |
| . | 01263 | ADD | A*W(FBESSEL+2)*SKIP | 01272 | 20130 | 01050 | |
| . | 01264 | JP | B0THNEG1 | 01273 | 61000 | 01303 | |
| . | 01265 | JP | N0FL01*AP0S | 01274 | 60600 | 01202 | |

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| CARDS | LI | ID | LABEL | TA | STATEMENT | LOC | F | JKB | Y | NOTES |
|-------|-------|----------|-------|----|-------------------------|-------|-------|-------|---|-------|
| • | 01266 | | | | SEL CL*W(KEY) | 01275 | 52030 | 01017 | | |
| • | 01267 | | | | STR A*W(FBESSEL) | 01276 | 15030 | 01046 | | |
| • | 01270 | | | | ENT Q*W(BESSEL+2) | 01277 | 10030 | 01035 | | |
| • | 01271 | | | | ADD Q*1 | 01300 | 26000 | 00001 | | |
| • | 01272 | | | | RPL Y+Q*W(BESSEL) | 01301 | 34030 | 01033 | | |
| • | 01273 | | | | JP FIX1+3 | 01302 | 61000 | 01206 | | |
| • | 01274 | B0THNEG1 | | | ADD A*W(FBESSEL+2) | 01303 | 20030 | 01050 | | |
| • | 01275 | | | | JP N0FL01*ANEG | 01304 | 60700 | 01202 | | |
| • | 01276 | | | | SEL SET*W(KEY) | 01305 | 50030 | 01017 | | |
| • | 01277 | | | | STR A*W(FBESSEL) | 01306 | 15030 | 01046 | | |
| • | 01300 | | | | ENT Q*W(BESSEL+2) | 01307 | 10030 | 01035 | | |
| • | 01301 | | | | SUB Q*1 | 01310 | 27000 | 00001 | | |
| • | 01302 | | | | RPL Y+Q*W(BESSEL) | 01311 | 34030 | 01033 | | |
| • | 01303 | | | | JP FIX1+3 | 01312 | 61000 | 01206 | | |
| • | 01304 | FL0TEST2 | | | ENT A*W(FBESSEL)*ANEG | 01313 | 11730 | 01046 | | |
| • | 01305 | | | | ADD A*W(FBESSEL+3)*SKIP | 01314 | 20130 | 01051 | | |
| • | 01306 | | | | JP B0THNEG2 | 01315 | 61000 | 01325 | | |
| • | 01307 | | | | JP N0FL02*AP0S | 01316 | 60600 | 01210 | | |
| • | 01310 | | | | SEL CL*W(KEY) | 01317 | 52030 | 01017 | | |
| • | 01311 | | | | STR A*W(FBESSEL) | 01320 | 15030 | 01046 | | |
| • | 01312 | | | | ENT Q*W(BESSEL+3) | 01321 | 10030 | 01036 | | |
| • | 01313 | | | | ADD Q*1 | 01322 | 26000 | 00001 | | |
| • | 01314 | | | | RPL Y+Q*W(BESSEL) | 01323 | 34030 | 01033 | | |
| • | 01315 | | | | JP FIX2+3 | 01324 | 61000 | 01214 | | |
| • | 01316 | B0THNEG2 | | | ADD A*W(FBESSEL+3) | 01325 | 20030 | 01051 | | |
| • | 01317 | | | | JP N0FL02*ANEG | 01326 | 60700 | 01210 | | |
| • | 01320 | | | | SEL SET*W(KEY) | 01327 | 50030 | 01017 | | |
| • | 01321 | | | | STR A*W(FBESSEL) | 01330 | 15030 | 01046 | | |
| • | 01322 | | | | ENT Q*W(BESSEL+3) | 01331 | 10030 | 01036 | | |
| • | 01323 | | | | SUB Q*1 | 01332 | 27000 | 00001 | | |
| • | 01324 | | | | RPL Y+Q*W(BESSEL) | 01333 | 34030 | 01033 | | |
| • | 01325 | | | | JP FIX2+3 | 01334 | 61000 | 01214 | | |
| • | 01326 | FL0TEST3 | | | ENT A*W(FBESSEL)*ANEG | 01335 | 11730 | 01046 | | |
| • | 01327 | | | | ADD A*W(FBESSEL+4)*SKIP | 01336 | 20130 | 01052 | | |
| • | 01330 | | | | JP B0THNEG3 | 01337 | 61000 | 01347 | | |
| • | 01331 | | | | JP N0FL03*AP0S | 01340 | 60600 | 01216 | | |
| • | 01332 | | | | SEL CL*W(KEY) | 01341 | 52030 | 01017 | | |
| • | 01333 | | | | STR A*W(FBESSEL) | 01342 | 15030 | 01046 | | |
| • | 01334 | | | | ENT Q*W(BESSEL+4) | 01343 | 10030 | 01037 | | |
| • | 01335 | | | | ADD Q*1 | 01344 | 26000 | 00001 | | |

FRACHTMAN*7/14/64

SUNTRACK

NOTES

TA STATEMENT

LI ID LABEL

CARDS

F JKB Y

LOC

| CARDS | LI ID LABEL | TA STATEMENT | LOC | F JKB Y | NOTES |
|-------|-------------|--------------------|-------|---------|-------|
| • | 01336 | RPL Y+Q*W(BESSEL) | 01345 | 34030 | 01033 |
| • | 01337 | JP FIX3+3 | 01346 | 61000 | 01222 |
| • | 01340 | ADD A*W(FBESSEL+4) | 01347 | 20030 | 01052 |
| • | 01341 | JP N0FL03*ANEG | 01350 | 60700 | 01216 |
| • | 01342 | SEL SET*W(KEY) | 01351 | 50030 | 01017 |
| • | 01343 | STR A*W(FBESSEL) | 01352 | 15030 | 01046 |
| • | 01344 | ENT Q*W(BESSEL+4) | 01353 | 10030 | 01037 |
| • | 01345 | SUB Q*1 | 01354 | 27000 | 00001 |
| • | 01346 | RPL Y+Q*W(BESSEL) | 01355 | 34030 | 01033 |
| • | 01347 | JP FIX3+3 | 01356 | 61000 | 01222 |
| • | 01350 | LSH AQ*29D | 01357 | 07000 | 00035 |
| • | 01351 | SEL SET*W(KEY) | 01360 | 50030 | 01017 |
| • | 01352 | JP ST0R1 | 01361 | 61000 | 01120 |
| • | 01353 | LSH AQ*29D | 01362 | 07000 | 00035 |
| • | 01354 | SEL SET*W(KEY) | 01363 | 50030 | 01017 |
| • | 01355 | JP ST0R2 | 01364 | 61000 | 01137 |
| • | 01356 | LSH AQ*29D | 01365 | 07000 | 00035 |
| • | 01357 | SEL SET*W(KEY) | 01366 | 50030 | 01017 |
| • | 01360 | JP ST0R3 | 01367 | 61000 | 01160 |
| • | 01361 | LSH AQ*29D | 01370 | 07000 | 00035 |
| • | 01362 | SEL SET*W(KEY) | 01371 | 50030 | 01017 |
| • | 01363 | JP ST0R4 | 01372 | 61000 | 01176 |
| • | 01364 | ENTRY | 01373 | 61000 | 00000 |
| • | 01365 | JP MIKE*ANEG | 01374 | 60700 | 01400 |
| • | 01366 | LSH AQ*B5*QP0S | 01375 | 07205 | 00000 |
| • | 01367 | ADD A*1 | 01376 | 20000 | 00001 |
| • | 01370 | EXIT | 01377 | 61010 | 01373 |
| • | 01371 | LSH AQ*B5*QNEG | 01400 | 07305 | 00000 |
| • | 01372 | SUB A*1 | 01401 | 21000 | 00001 |
| • | 01373 | EXIT | 01402 | 61010 | 01373 |
| • | 01374 | ENTRY | 01403 | 61000 | 00000 |
| • | 01375 | JP MAX*ANEG | 01404 | 60700 | 01410 |
| • | 01376 | RSH AQ*B5*QP0S | 01405 | 03205 | 00000 |
| • | 01377 | ADD A*1 | 01406 | 20000 | 00001 |
| • | 01400 | EXIT | 01407 | 61010 | 01403 |
| • | 01401 | RSH AQ*B5*QNEG | 01410 | 03305 | 00000 |
| • | 01402 | SUB A*1 | 01411 | 21000 | 00001 |
| • | 01403 | EXIT | 01412 | 61010 | 01403 |
| • | 01404 | YRREMAIN | 01413 | 00000 | 00000 |
| • | 01405 | WHOLEYEAR | 01414 | 00000 | 00000 |

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1. ORIGINATING ACTIVITY (Corporate author)
LINCOLN LABORATORY M.I.T.
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2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP N/A

3. REPORT TITLE

CHD HAYSTACK POINTING SYSTEM: SUN

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

GROUP REPORT

5. AUTHOR(S) (Last name, first name, initial)

FRACHTMAN, H. E.

6. REPORT DATE

29 July 1964

7a. TOTAL NO. OF PAGES

36

7b. NO. OF REFS

3

8a. CONTRACT OR GRANT NO.

AF 19(628)-500

b. PROJECT NO.

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)

1964-40

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

ESD-TDR-64-355

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This memorandum describes the method used by the Haystack pointing computer program for obtaining the celestial coordinates of the SUN at any time.

| | | | | | | |
|---|--------|----|--------|----|--------|----|
| 14. KEY WORDS | LINK A | | LINK B | | LINK C | |
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